Arkansas’s Role in Energy Transmission Management

The National Science Academies - Building the Arkansas Innovation Economy
March 8, 2010

Nick Brown, President & CEO, SPP
Helping our members work together to keep the lights on... today & in the future
Our Beginning

• Founded 1941 with 11 members

  Utilities pooled resources to keep Arkansas aluminum plant powered for critical defense

• Maintained after WWII for reliability and coordination
Operating Region

- 370,000 square miles service territory
- 50,575 miles transmission lines:
  - 69 kV – 16,182 miles
  - 115 kV – 10,041 miles
  - 138 kV – 9,284 miles
  - 161 kV – 4,469 miles
  - 230 kV – 3,831 miles
  - 345 kV – 6,662 miles
  - 500 kV – 106 miles
Members in nine states:

Arkansas    Mississippi    New Mexico
Kansas      Missouri       Oklahoma
Louisiana   Nebraska       Texas
56 SPP Members

- Investor-Owned: 14
- Cooperatives: 11
- Municipals: 9
- Independent Transmission Companies: 3
- Independent Power Producers / Wholesale Generation: 5
- Marketers: 10
- State Agencies: 4
**SPP at a Glance**

- Little Rock based
- 439+ employees
- $120M operating
  $70M capital
- 24 x 7 operation
- Full redundancy and backup site
Reliability Coordination

• Monitor interconnected network
• Anticipate problems
• Take preemptive action
• Coordinate regional response
• Independent administration

As “Air Traffic Controllers,” our operators comply with…

…over 1,300 pages of reliability standards and criteria.
Transmission Service

- Provide one-stop shopping
- Consistent rates, terms, & conditions
- Regional focus
- Independent administration
- Process > 15,000 transactions/month

As “Sales Agents,” we administer …

...an 872 page transmission rate tariff on behalf of our members and customers.
Market Operation

- Monitor resource / load balance
- Ensure the most economic dispatch, provided system reliability is met
- Provide settlement data for market services

SPP’s Energy Market is like the “NYSE”...

…and follows over 200 pages of market protocols.
The Regional Outlook Assessment...
Actual & Forecast Peak Demand

% Growth Rate

-2 -1 0 1 2 3 4


Actual
Forecasted
Quick Statistics

- 66,175 megawatts capacity resources
- 847 plants – 6,079 substations

<table>
<thead>
<tr>
<th>Fuel Type</th>
<th>Percentage Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal</td>
<td>40%</td>
</tr>
<tr>
<td>Gas/Oil</td>
<td>42%</td>
</tr>
<tr>
<td>Nuclear</td>
<td>3%</td>
</tr>
<tr>
<td>Hydro</td>
<td>4%</td>
</tr>
<tr>
<td>Wind</td>
<td>4%</td>
</tr>
<tr>
<td>Other</td>
<td>7%</td>
</tr>
</tbody>
</table>
## Needed New Generation by 2017 (MW)

<table>
<thead>
<tr>
<th>Planned</th>
<th>Proposed</th>
<th>12% CM</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>5,849</td>
<td>2,758</td>
<td>1,452</td>
<td>10,059</td>
</tr>
</tbody>
</table>

*With an average size baseload unit of 500 MW,*

*we need more than 20 new units within 10 years!!*
Perfect Storm of Complex Issues

- Growth in demand
- Political and technical challenges
- Challenges with integrating renewables into grid
- Lack of transmission
- Rising gas prices
- Greenhouse gas emissions
- Aging infrastructure
- Trade imbalance
- Lengthy permitting for new generation
- Growth in uncommitted capacity
There is no...
The solution will take...
Immediate National Leadership Mandating:

- A broad portfolio approach to electric generation resources to meet demand & reduce emissions
- Expansion of bulk electric transmission to deliver remote renewables & baseload generation alternatives
- Significant research, development and demonstration of carbon capture & storage, renewables, and efficiency and demand response technologies
An Important Role for Renewables...
Annual Average 80m wind speed

firstlook.3tiergroup.com
Wind In Service: 2001

Source: NREL
Wind Installed by Year (2002-2009)

<table>
<thead>
<tr>
<th>Year</th>
<th>Megawatts Installed</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002*</td>
<td>190</td>
</tr>
<tr>
<td>2003</td>
<td>102</td>
</tr>
<tr>
<td>2004</td>
<td>74</td>
</tr>
<tr>
<td>2005</td>
<td>648</td>
</tr>
<tr>
<td>2006</td>
<td>80</td>
</tr>
<tr>
<td>2007</td>
<td>474.5</td>
</tr>
<tr>
<td>2008</td>
<td>300</td>
</tr>
<tr>
<td>2009</td>
<td>887</td>
</tr>
</tbody>
</table>

* Not overseen by SPP

Source: SPP

SPP.org
Renewable Energy Standards By State

Source: SPP
Generation Interconnection Requests

All Generation Interconnection data taken from GI Queue on 2/2/2010.
Request locations shown are approximate locations of new generation. Points of interconnection are not displayed on this map.

Status of GI Request
- Signed IA/in Service
- Signed IA/On Schedule
- Signed IA/On Suspension
- Under Study
- Feasibility Study Requested

GI Requests (Wind)
Correlation Between Wind and Load

April 18 - 24 2005
Oklahoma, Wind, and Economic Development

- Economic benefit of 1,000 MW = $1.25 billion
  - 5,530 construction jobs, 215 permanent jobs
- Average wages in component manufacturing industry = $40,709 - 15% higher than average state wage
- Strong correlation between Western OK counties that have lost population in recent decades with counties that have significant wind resources
- In many cases, land suited for wind development has lower per-acre returns for agricultural use
- Sooner Survey of 600 registered voters:
  - 72% of Oklahomans willing to pay more for wind-generated electricity
  - 91% approve of further development of wind farms

Source: NREL; Cole, Hargrave Snodgrass, and Associates; Oklahoma Department of Commerce
Arkansas Becoming Manufacturing Hub

- **LM Glasfiber**
  - Employs 300 workers @ $12-$15/hour
  - Invested $95 million in Little Rock

- **Mitsubishi Power Systems**
  - Announced October 2009
  - $100 million plant will bring 400 jobs in 2011

- **Nordex**
  - Sept 2009 - Broke ground on $100 million plant
  - Expected to employ 700 by 2014

- **Emergya Wind Technologies/Polymarin**
  - Plans to invest $16 M and create 830 jobs @ $15/hour

Sources: NREL, AR Economic Dev. Commission, Nordex, Arkansas Business
Transmission – 10%
Constraining 90%...
SPP is Building Transmission

NEW SPP Transmission - Circuit Miles

Historical

Projected

Circuit Miles

YEAR

2006 2007 2008 2009 2010

700 kV
300 kV
200 kV
100 kV
69 kV
Transmission Expansion - Costs

Cost of New SPP Transmission - Circuit Miles and Associated Upgrades

- Historical
- Projected

YEAR
- 2006
- 2007
- 2008
- 2009
- 2010

Cost in Millions
- 0
- 50
- 100
- 150
- 200
- 250
- 300
- 350
- 400

SPP.org 30
Draft EHV Overlay
MAJOR TRANSMISSION EXPANSION IN AND AROUND SPP
Examples of Transmission Benefits

- Fuel Diversity
- Market Liquidity Improvements
- Ability to Idle High Cost/Environmental Impact Resources
- Energy Capacity and Ancillary Market Facilitation
- Storm Hardening
- Increased Competition
- Extreme Reliability Event Mitigation (n-1) and (n-2) Weather & Wind
- Ability to Serve New Load
- Capacity Factor Improvement of Wind Resources
- Reserve Margin Reduction
- Export and Import Improvement
- Improved Operational Efficiencies

High voltage transmission “superhighways” would move more power more efficiently over long distances at lower costs.
Quantitative Benefits

• The Brattle Group Study quantified NPV benefits of $1.5 billion over 40 years

• B/C Ratio of 0.7

<table>
<thead>
<tr>
<th>Total</th>
<th>$$</th>
<th>B/C Ratio</th>
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<tbody>
<tr>
<td>APC</td>
<td>$819 M</td>
<td>0.41</td>
</tr>
<tr>
<td>Losses</td>
<td>$26 M</td>
<td>0.01</td>
</tr>
<tr>
<td>Wind Revenue*</td>
<td>$266 M</td>
<td>0.13</td>
</tr>
<tr>
<td>Fuel Diversity</td>
<td>$399 M</td>
<td>0.20</td>
</tr>
<tr>
<td>Reliability</td>
<td>$-20 M</td>
<td>(0.01)</td>
</tr>
<tr>
<td>*(Adjusted down)</td>
<td>$1.5 B</td>
<td>0.74</td>
</tr>
</tbody>
</table>
## Qualitative Benefits

<table>
<thead>
<tr>
<th>Total (B/C at 20% of $$)</th>
<th>$$</th>
<th>B/C Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taxes (table 28):</td>
<td>$34 M</td>
<td>0.00</td>
</tr>
<tr>
<td>Econ. Trans (table 27)</td>
<td>$1,000 M</td>
<td>0.10</td>
</tr>
<tr>
<td>Wind Earning (table 5a)</td>
<td>$560 M</td>
<td>0.06</td>
</tr>
<tr>
<td>Econ Operating (table 5a)</td>
<td>$1,900 M</td>
<td>0.19</td>
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<tr>
<td>Wind Earning Construct (table 5a)</td>
<td>$766 M</td>
<td>0.08</td>
</tr>
<tr>
<td>Econ Construction (table 5a)</td>
<td>$2,300 M</td>
<td>0.23</td>
</tr>
<tr>
<td>Total</td>
<td>$6,500 B</td>
<td>0.66</td>
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</tbody>
</table>
Larger Transmission Reduces Right of Way
# Highway/Byway Cost Allocation

<table>
<thead>
<tr>
<th>Voltage</th>
<th>Regional</th>
<th>Zonal</th>
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</thead>
<tbody>
<tr>
<td>300 kV and above</td>
<td>100%</td>
<td>0%</td>
</tr>
<tr>
<td>100 kV - 299 kV</td>
<td>1/3</td>
<td>2/3</td>
</tr>
<tr>
<td>Below 100 kV</td>
<td>0%</td>
<td>100%</td>
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